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Lee

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(54) **SOLENOID VALVE FOR BRAKE SYSTEM AND MANUFACTURING METHOD THEREOF**

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(51) **Int. Cl.**
F16K 31/02 (2006.01)

(52) **U.S. Cl.** **251/129.15**; 303/119.2

(58) **Field of Classification Search** 251/129.15; 303/119.2

See application file for complete search history.

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(57) **ABSTRACT**

Disclosed herein are a solenoid valve for a brake system and a manufacturing method thereof, to achieve easy manufacture and low manufacturing costs via a more simplified configuration than the related art. The solenoid valve includes a valve core, a sleeve into one side of which the valve core is inserted, an armature movably received in the sleeve, a seat having an orifice that is opened or closed by the armature, a return spring to press the armature toward the orifice, a filter member press-fitted in a modulator block having an inlet path and outlet path, a filter being coupled to the filter member, and a seat housing having one side press-fitted into the filter member and the other side press-fitted into the sleeve, the seat being press-fitted in the seat housing. The seat housing takes the form of a tubular member having an approximately constant thickness and is provided with a stepped portion to determine a position of the seat.

3 Claims, 3 Drawing Sheets

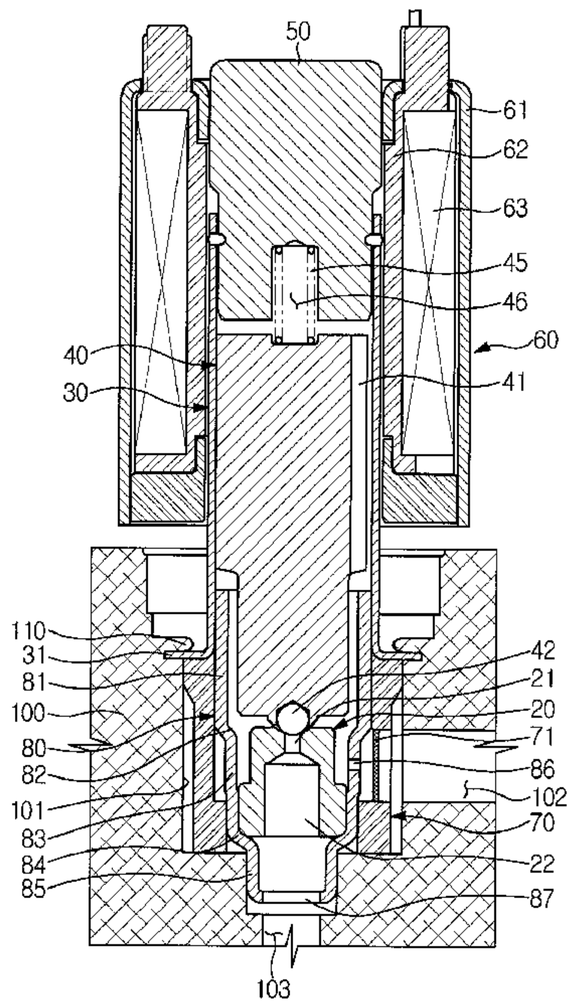
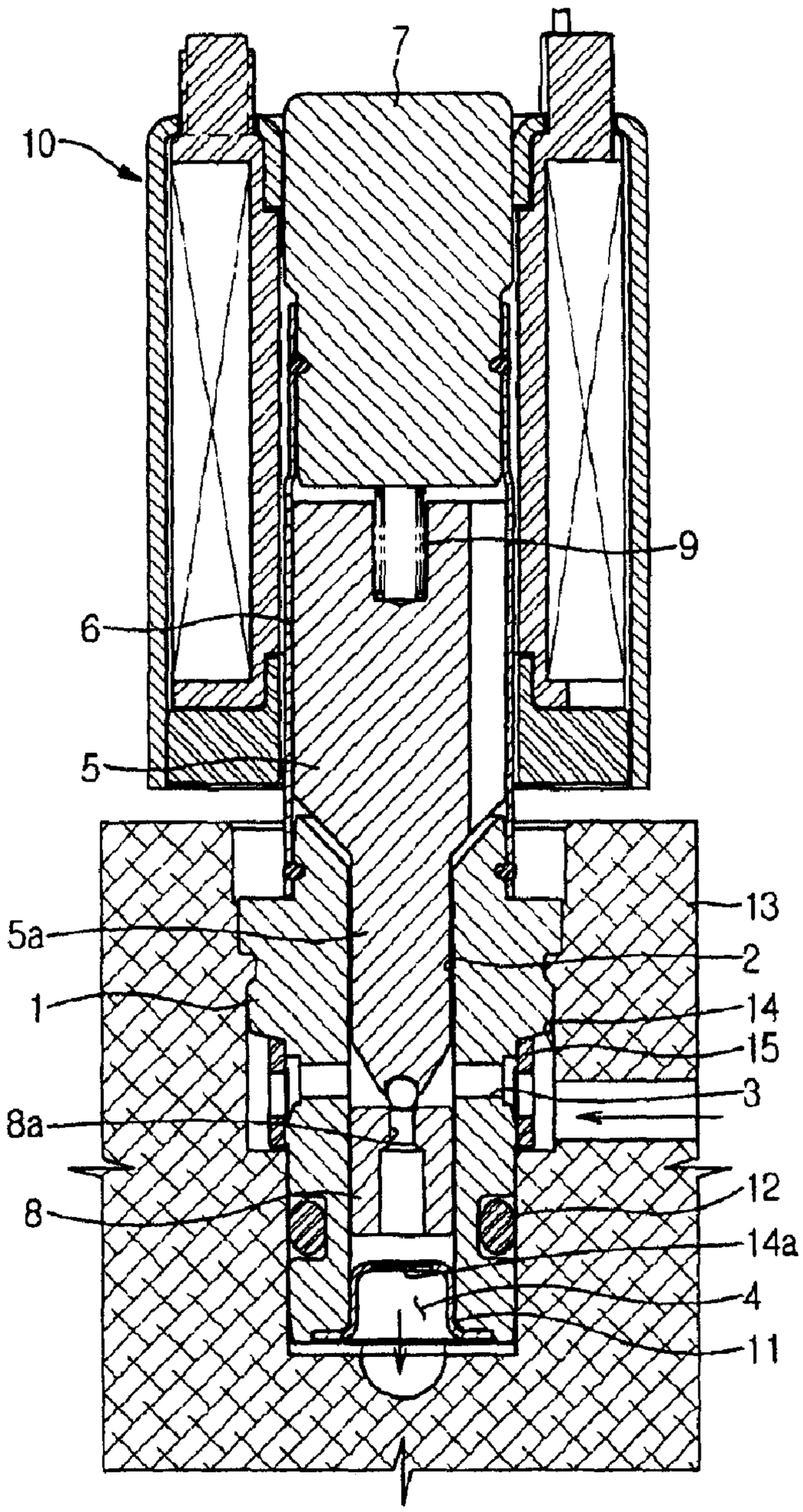


FIG. 1



PRIOR ART

FIG. 2

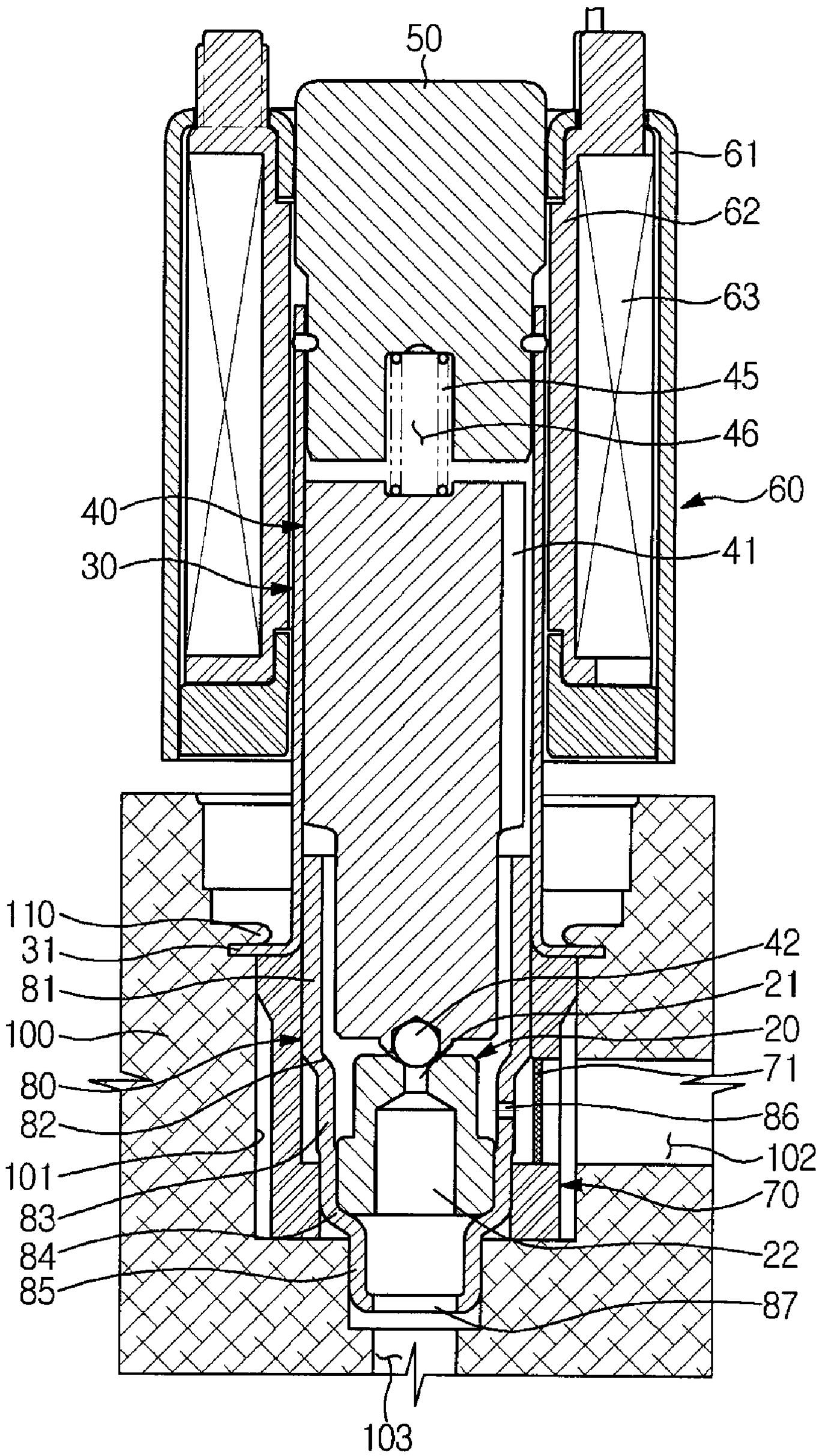

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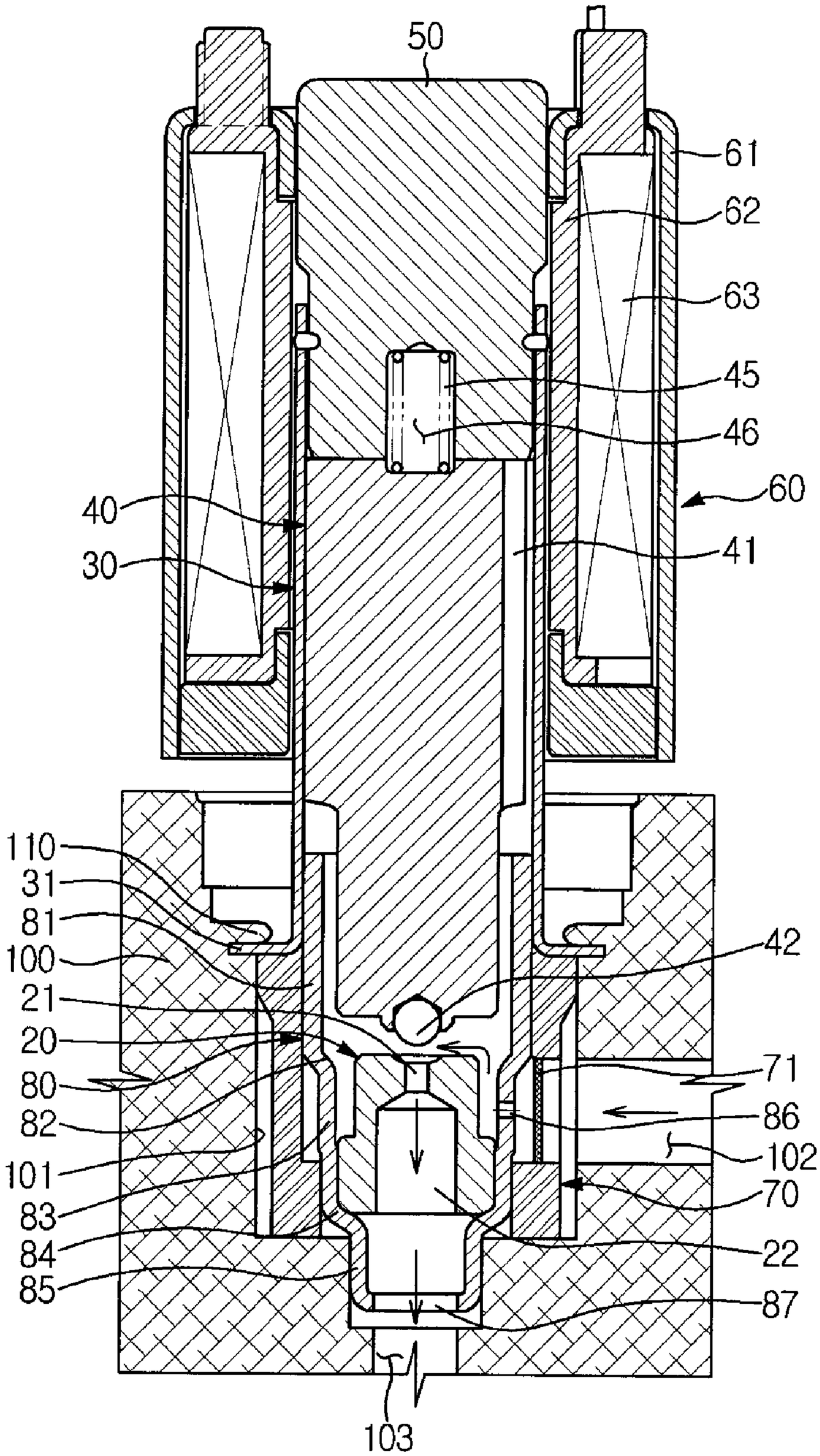
FIG. 3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SOLENOID VALVE FOR BRAKE SYSTEM AND MANUFACTURING METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Korean Patent Application No. 2008-0063777, filed on Jul. 2, 2008 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

1. Field

Embodiments of the present invention relate to a solenoid valve for a brake system and a manufacturing method thereof, to assure easier manufacture and lower manufacturing costs than the related art.

2. Description of the Related Art

A general vehicular anti-lock brake system is designed to prevent wheel lockup when braking hard by controlling braking pressure applied to wheels based on sensed tire slip.

This assures directional stability and steering control of wheels without tire slip during braking and consequently, safe braking.

This type of brake system includes a plurality of solenoid valves that opens or closes flow-paths of brake hydraulic lines to control braking pressure. Solenoid valves may be classified into normally opened type solenoid valves that are normally kept in an opened state, and normally closed type solenoid valves that are normally kept in a closed state.

FIG. **1** is a sectional view illustrating a conventional normally closed type solenoid valve. The valve is press-fitted into a bore **14** of a modulator block **13** in which flow-paths of a brake system are defined. The valve includes a hollow valve housing **1** having an inlet **3** and an outlet **4** for fluid flow.

A cylindrical sleeve **6** is inserted into one end of the valve housing **1** and in turn, an armature **5** is movably received in the sleeve **6**. A valve core **7** is fitted into an open end of the sleeve **6**. The valve core **7** serves not only to close an opening of the sleeve **6**, but also to move the armature **5**. The armature **5** is moved to open or close a first orifice **8***a* of a valve seat **8**. For this, the armature **5** has an opening/closing portion **5***a* extending toward the valve seat **8** through a hollow **2** of the valve housing **1**.

A return spring **9** is interposed between the armature **5** and the valve core **7**. The return spring **9** presses the armature **5** to allow the armature **5** to normally close the first orifice **8***a*. An excitation coil assembly **10** is installed around the sleeve **6** and valve core **7** for movement of the armature **5**. A second orifice member **11** having a second orifice **14***a* is inserted in the valve housing **1**, and an O-ring **12** is fitted around the valve housing **1** to seal a gap between the valve housing **1** and an inner surface of the bore **14**. Also, a filter member **15** having a filter is fitted around the valve housing **1**.

In operation of the above-described solenoid valve, when power is applied to the excitation coil assembly **10** to generate magnetic force, the armature **5** is moved toward the valve core **7** by the magnetic force, thus operating to open the orifice **8***a* of the valve seat **8**. On the other hand, no magnetic force is exerted when no power is applied to the excitation coil assembly **10** and thus, the armature **5** operates to close the orifice **8***a* by elasticity of the return spring **9**.

As described above, the conventional solenoid valve for a brake system is configured such that the valve seat is provided separately from the valve housing and thus, is press-fitted in

the valve housing. The valve housing has been mainly formed by forging and therefore, has a great number of components. This results in difficult manufacture and higher production price.

SUMMARY

Therefore, it is an aspect of the present invention to provide a solenoid valve for a brake system and a manufacturing method thereof, to achieve easy manufacture and low manufacturing costs via a more simplified configuration than the related art.

Additional aspects of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

In accordance with one aspect of the present invention, a solenoid valve for a brake system includes a valve core, a sleeve into one side of which the valve core is inserted, an armature movably received in the sleeve, a seat having an orifice that is opened or closed by the armature, a return spring to press the armature toward the orifice, a filter member press-fitted in a modulator block having an inlet path and outlet path, a filter being coupled to the filter member, and a seat housing having one side press-fitted into the filter member and the other side press-fitted into the sleeve, the seat being press-fitted in the seat housing, wherein the seat housing takes the form of a tubular member having an approximately constant thickness and is provided with a stepped portion to determine a position of the seat.

The sleeve may be provided at an end thereof with a flange to allow the sleeve to be coupled to the modulator block.

In accordance with another aspect of the present invention, in a manufacturing method of a solenoid valve for a brake system of claim **1** or **2**, the seat housing is integrally formed by deep drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. **1** is a sectional view of a conventional normally closed type solenoid valve;

FIG. **2** is a sectional view of a solenoid valve for a brake system according to an embodiment of the present invention, illustrating a closed state of an orifice; and

FIG. **3** is a sectional view of the solenoid valve according to the embodiment, illustrating an opened state of the orifice.

DETAILED DESCRIPTION

Reference will now be made in detail to the embodiment of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

FIG. **2** is a sectional view of a solenoid valve for a brake system according to an embodiment of the present invention and illustrates a closed state of an orifice.

The solenoid valve for a brake system according to the present embodiment, as shown in FIG. **2**, includes an excitation coil assembly **60**, a valve core **50**, a sleeve **30**, a return spring **45**, an armature **40**, a seat **20**, a seat housing **80**, and a filter member **70**.

Considering first the excitation coil assembly **60**, the excitation coil assembly **60** has a cylindrical form and is coupled

to an outer surface of the valve core **50** and to an outer surface of an upper part of the sleeve **30**. The excitation coil assembly **60** includes a cylindrical coil case **61**, a bobbin **62** received in the coil case **61**, and an excitation coil **63** wound on an outer surface of the bobbin **62**.

When power is applied to the excitation coil **63**, a magnetic field is generated to move the armature **40** toward the valve core **50**, causing an orifice **21** to be opened.

The valve core **50** is press-fitted into an upper end of the sleeve **30** and may be fixed by welding. A spring receiving recess **46** is formed in a lower surface of the valve core **50**, in which the return spring may be received. Of course, the spring receiving recess **46** may be formed in an upper surface of the armature **40**.

The return spring **45** is located between the valve core **50** and the armature **40** and normally presses the armature **40** toward the seat **20**. As the return spring **45** presses the armature **40** toward the seat **20**, normally, the orifice **21** may be closed by a sphere **42**.

The armature **40** is vertically movably received in the sleeve **30**. The armature **40** takes the form of a cylinder having an outer diameter corresponding to an inner diameter of the sleeve **30**. An armature path **41** for oil flow is vertically defined in an outer surface of the armature **40**. The sphere **42** is fitted in a lower end of the armature **40**, to close the orifice **21** of the seat **20**. Thus, the orifice **21** may be opened or closed by movement of the armature **40**. Of course, the armature **40** may have its own opening/closing protrusion to open or close the orifice **21** without the sphere **42**. The armature **40** is movable under guidance of an inner surface of the sleeve **30**.

The sleeve **30** has a cylindrical form and is provided at one end thereof with a flange **31**. The seat housing **80** is press-fitted into the end where the flange **31** is formed.

The flange **31** is secured to a modulator block **100** by a deformed portion **110** of the modulator block **100**. The deformed portion **110** is caused by pressure applied around the flange **31** after the solenoid valve is press-fitted into the modulator block **100**. Thus, the solenoid valve may be simply secured to the modulator block **100** without a separate member.

The orifice **21** of the seat **20** is formed in an upper surface of the seat **20**, so as to be opened or closed by the sphere **42** of the armature **40**. The seat **20** is further formed with an inner path having an inner diameter greater than that of the orifice **21**. The seat **20** is press-fitted in the seat housing **80**.

The seat housing **80** includes a large-radius portion **81** to be press-fitted into the sleeve **30**. A first stepped portion **82** is provided below the large-radius portion **81** and in turn, a small-radius portion **83** is provided below the first stepped portion **82**, the small-radius portion **83** having a radius smaller than that of the large-radius portion **81**. Also, a second stepped portion **84** is provided below the small-radius portion **83** and in turn, a discharge path **85** is provided below the second stepped portion **84**, the discharge path **85** having a radius smaller than that of the small-radius portion **83**. The seat **20** is press-fitted into the seat housing **80** until a lower end of the seat **20** reaches the second stepped portion **84** formed between the small-radius portion **83** and the discharge path **85**. Thus, the second stepped portion **84** determines the position of the seat **20** and prevents the seat **20** from dropping further downward.

An oil inlet **86** is perforated in a side of the small-radius portion **83**, through which oil from an inlet path **102** of the modulator block **100** passes. Also, an oil outlet **87** is formed in a lower end of the discharge path **85** and is connected to a discharge path **103** of the modulator block **100**.

The seat housing **80** is formed by deep drawing of a metal plate. This may assure easier product manufacture than a conventional complicated forged product. Also, the seat housing **80** may take the form of an integral member without requiring several components as in the related art. This may entail enhanced workability and cost reduction.

The filter member **70** is press-fitted in the modulator block **100**, and a filter **71** is located in the inlet path **102** of the modulator block **100** to remove contaminants introduced thereinto. The seat housing **80** is press-fitted into the filter member **70**.

Now, opening/closing operation of the above-described solenoid valve will be described.

FIG. **2** is a sectional view of the solenoid valve according to the embodiment and illustrates a closed state of the orifice. As shown in FIG. **2**, when no power is applied to the excitation coil **63**, the return spring **45** pushes the armature **40** toward the orifice **21**, thus causing the sphere **42** of the armature **40** to close the orifice **21**. Thus, no oil flows from the inlet **86** to the orifice **21**.

FIG. **3** is a sectional view of the solenoid valve according to the embodiment and illustrates an opened state of the orifice. As shown in FIG. **3**, when power is applied to the excitation coil **63**, the armature **40** overcomes elasticity of the return spring **45** by magnetic force generated between the armature **40** and the valve core **50**, thus moving toward the valve core **50** and consequently, opening the orifice **21**.

As is apparent from the above description, in a solenoid valve according to the embodiment of the present invention, a seat housing is formed by deep drawing of a metal plate, thus assuring easier product manufacture than a conventional complicated forged product. Also, the seat housing may take the form of an integral member without requiring several components as in the related art and this may entail enhanced workability and cost reduction.

Further, in a configuration wherein a flange of the solenoid valve is coupled to a deformed portion of a modulator block, the deformed portion may be obtained by pressure applied around the flange after the solenoid valve is press-fitted into the modulator block. Therefore, the solenoid valve may be simply secured to the modulator block without a separate member.

Furthermore, by press-fitting a seat into a specific stepped portion of a seat housing between a small-radius portion and a discharge path of the seat housing, positioning of the seat may be possible to prevent the seat from dropping further, resulting in easy assembly operation.

Although the embodiment of the present invention has been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A solenoid valve for a brake system comprising:

a valve core;

a sleeve into one side of which the valve core is inserted;

an armature movably received in the sleeve;

a seat having an orifice that is opened or closed by the armature;

a return spring to press the armature toward the orifice;

a filter member press-fitted in a modulator block having an inlet path and outlet path, a filter being coupled to the filter member; and

a seat housing having one side press-fitted into the filter member and the other side press-fitted into the sleeve, the seat being press-fitted in the seat housing, wherein

the seat housing takes the form of a tubular member having an approximately constant thickness and is provided with a stepped portion to determine a position of the seat.

2. The solenoid valve according to claim **1**, wherein the sleeve is provided at an end thereof with a flange to allow the sleeve to be coupled to the modulator block.

3. A manufacturing method of a solenoid valve for a brake system of claim **1**, wherein the seat housing is integrally formed by deep drawing.

* * * * *